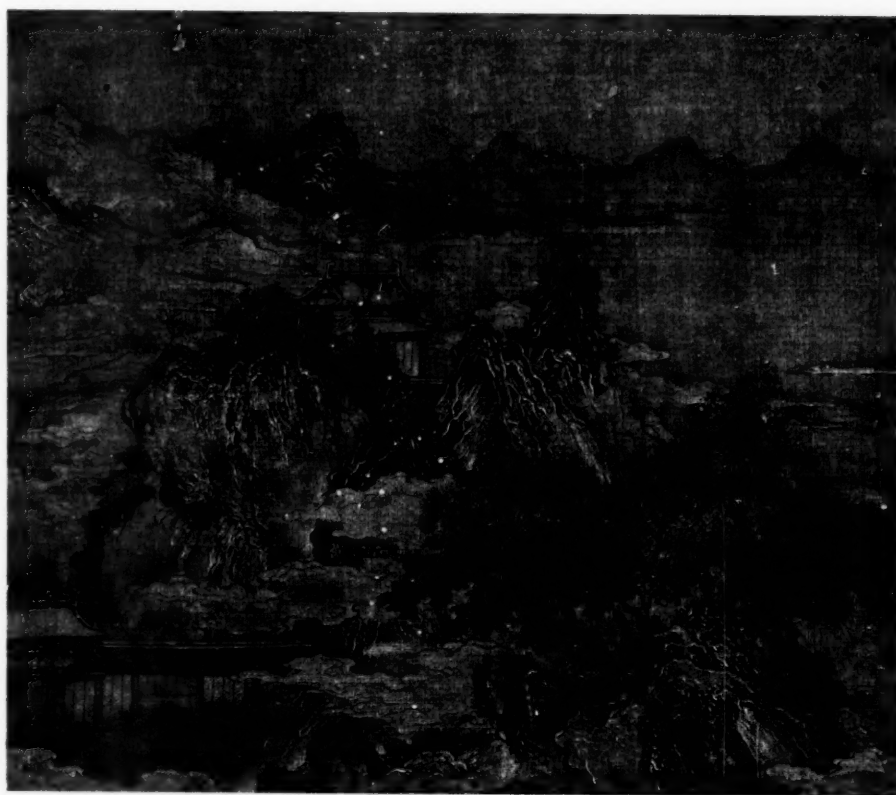


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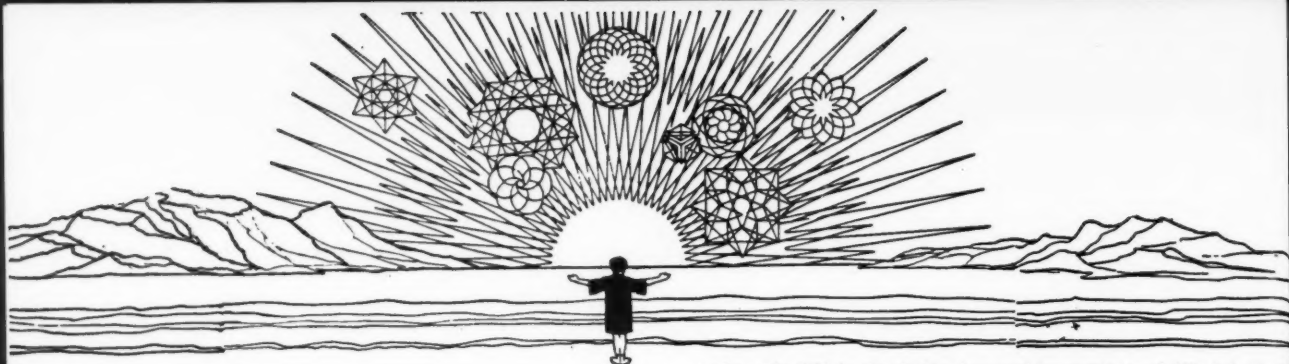


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MAIN CURRENTS

IN MODERN THOUGHT

A cooperative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.

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A PHILOSOPHY OF PSYCHOLOGY *

A. H. Maslow

Brandeis University

The Need for a Mature Science of Human Nature

I want to begin my remarks with a credo, a personal statement, which admittedly sounds presumptuous, but is nonetheless necessary.

I believe that psychologists occupy the most centrally important position in the world today. I say this because all the important problems of mankind—war and peace, exploitation and brotherhood, hatred and love, sickness and health, misunderstanding and understanding, happiness and unhappiness—will yield only to a better understanding of human nature, and to this psychology alone wholly applies itself. Therefore I believe that medicine and physics, law and government, education, economics, engineering, business and industry, are only tools, though admittedly powerful. They are means but not ends; the end is human betterment.

The ultimate end to which they should all be bent, then, is human fulfillment, growth and happiness. But these tools produce such good and desirable results only when rightly used by good men. Wrongly and ignorantly used by evil men, they produce nothing but disaster. The wrong, the evil, lie in the men, not in the tools, and the only way to heal the sickness which displays itself as evil is to create good men by understanding the causes of the sickness and seeking the cures. Discovery of the nature of human good and evil, that is, of psychological health and psychological disease, is the job for which the psychologist tries to qualify himself.

Therefore I feel myself, as a psychologist, to be important as well as fortunate in being engaged in such a profession. Psychologists must be considered fortunate for several reasons. They deal with the most fascinating material in the world—human beings. They are, in a sense, their own studies, their own scientific

work, and so can work out even their own personal problems more efficiently. But still more important, everything that one man may discover through psychological research will be magnified a million times. For the more we learn about human nature, the more we automatically discover about all the other sciences, as well as law, history, philosophy, religion and industry, since these are all essentially human products. Basic to the study of law or education or economics or history should be an improved study of the human beings who have made the law and the history. Paul Valery has said it well: "When the mind is in question, everything is in question."

It must be quite clear by now that I speak out of a special conception of the vocation of the psychologist. It seems to me that psychology imposes definite rules and responsibilities upon its practitioners. The most pressing and urgent problems which face us today arise out of human weaknesses: sorrow, greed, exploitation, prejudice, contempt, cowardice, stupidity, jealousy and selfishness. We know, however, that these are diseases which are intrinsically curable. Psychoanalysis, for example, is one process of deep therapy that can handle these problems if it has enough time and skill.

Death in another shooting war, or a tense, neurotic, anxious existence in an extended cold war will inevitably result if human beings continue to misunderstand themselves and each other. If we improve human nature we improve all, for we remove the principal causes of world disorder. But human improvement depends upon an understanding of human nature, and the simple and unavoidable fact is that we just don't know enough about people. It is for this reason that the world needs the insights that psychology can with time produce. More than bombs or new religions or diplomats or factories, more than physical health and the new drugs to win it, we need an improved human nature.

* A lecture to a lay audience at Cooper Union, New York City, March 1956, edited and revised with the author's approval.

It is for these reasons that I feel a sense of historical urgency, as well as an increased awareness of the responsibility of the psychologist. This is a responsibility to the human race, and it should give the psychologist a sense of mission and a weight of duty beyond those of other scientists.

An important point I want to emphasize, however, is that my definition of psychologist is broad but specific. I mean to include not just professors of psychology but rather all those—and only those—who are interested in developing a truer, clearer, more empirical conception of human nature. This would exclude many professors of psychology and many psychiatrists, but would include some sociologists, anthropologists, educators, philosophers, theologians, publicists, linguists, business men, and so on.

There is one more qualification. Since psychology is in its infancy as a science, and so pitifully little is known by comparison with what we need to know, a good psychologist should be a humble man. Feeling his responsibility, he should be very conscious of how much he ought to know, and how little he actually does know. Unfortunately, too many psychologists are not humble, but are, rather, swollen with little knowledge. There is, in fact, no greater danger than an arrogant psychologist or psychiatrist.

With this preamble, I am going to cite below a number of "musts" which I feel are essential if psychology is to mature as a science and accept its full responsibilities.

I

PSYCHOLOGY should be more humanistic, that is, more concerned with the problems of humanity, and less with the problems of the guild.

The sad thing is that most students come into psychology with humanistic interests. They want to find out about people; they want to understand love, hate, hope, fear, ecstasy, happiness, the meaning of living. But what is so often done for these high hopes and yearnings? Most graduate, and even undergraduate, training turns away from these subjects, which are called fuzzy, unscientific, tender-minded, mystical. (I couldn't find the word "love" indexed in any of the psychology books on my shelves, even the ones on marriage.) Instead the student is offered dry bones, techniques, precision, and huge mountains of facts which have little relation to the interests which brought him into psychology. Even worse, they try, often successfully, to make the student *ashamed* of his interests as somehow unscientific. Thus the fine impulses of youth are often lost, and with them, the creativeness, the daring, the boldness, the unorthodoxy, the sense of high mission, the humanistic dedication. Cynicism closes in, and the student settles down to being a member of the guild, with all its prejudices and orthodoxies. I am horrified to report that most graduate students in psychology speak guardedly of the Ph.D. as the "union card," and tend to regard their dissertation research not as a privilege or an opportunity but as an unpleasant chore that must be

done in order to get a job.

What cultivated man in his right mind would read a doctoral dissertation, or an elementary textbook of psychology? The psychology books, approved by technical psychologists, which I could recommend to this audience are few. The only ones which would help you to understand man better are inexact and unscientific, coming more from the psychotherapeutic tradition than from the scientific psychologist. For instance, I recommend that you read Freud and the neo-Freudians, but I doubt that Freud could get a Ph.D. in psychology today, nor would any of his writings be acceptable as a doctoral dissertation. Only a few months ago, in a standard journal of psychology, a presidential address compared Freud with phrenology. And this for the greatest psychologist who has ever lived—at least from the point of view of non-members of the guild.

In exchange for Freud, Adler, Jung, Fromm and Horney, we are offered beautifully executed, precise, elegant experiments which, in at least half the cases, have nothing to do with enduring human problems, and which are written primarily for other members of the guild. It is all so reminiscent of the lady at the zoo who asked the keeper whether the hippopotamus was male or female. "Madam," he replied, "it seems to me that would be of interest only to another hippopotamus."

Psychologists are, or should be, an arm of the human race. They have obligations and responsibilities to everyone now living, and to the future. But they are not fulfilling them as they should.

II

PSYCHOLOGY should turn more frequently to the study of philosophy, of science, of aesthetics, and especially of ethics and values. The fact that psychology has officially cut itself off from philosophy means no more than that it has given up good philosophies for bad ones. Every man has a philosophy, albeit uncriticized, unconscious and uncorrected. If it is to be made more realistic, more useful and more fruitful, its possessor must work consciously to improve it.

A philosophy of psychology, in the sense in which I am using the term, includes the study of values. A philosophy of science should inquire into the meaning and purpose of science: how does it enrich us? It should also include a philosophy of aesthetics, of creativeness, of the highest and deepest experiences of which a human being is capable—what I call the peak-experiences. This is a way of avoiding shallowness, and of setting a suitably high level of aspiration.

Too many psychologists have sought their philosophy in the physical science concepts of the 19th century, apparently merely because these sciences were successful. But psychology is in its infancy as a science, and must work out its own philosophy and its own methodology, suitable to its own nature, problems and goals.

I do not mean to intimate by the foregoing that professors of philosophy are any better or worse than psychologists or physicists or chemists. There are as many sterile areas in philosophy as in any other field. Yet in philosophy there are also many points of penetration and advancement in human thought. Unless psychologists acquaint themselves with the heights of philosophical thought, they tend to remain arrogant rather than humble, trivial rather than profound, repetitious rather than creative.

Many psychologists are content to work with but a portion of the human being, indeed making a virtue out of such limitation. They forget that ultimately their task is to give us a unified, empirically based concept of the whole human being, i.e., a philosophy of human nature. This takes courage, and demands a willingness to step away from the narrow platform of certainty. Such certainty is of necessity narrow, for the reason, mentioned before, that our knowledge is insufficient to allow us to be sure of anything but small bits of the complex human problem.

Everyone, even the year-old child, has a conception of human nature, for it is impossible to live without a theory of how people will behave. Every psychologist, however positivistic and anti-theoretical he may claim to be, nevertheless has a full-blown philosophy of human nature hidden away within him. It is as if he guided himself by a half-known map, which he disavows and denies, and which is therefore immune to intrusion and correction by newly acquired knowledge. This unconscious map or theory guides his reactions far more than does his laboriously acquired experimental knowledge.

The issue is thus not over whether or not to have a philosophy of psychology, but whether to have one that is conscious or unconscious.

Another truth we can learn from philosophy is that we must have a map if we are not to waste time. It may sound sensible to say that as knowledge is based on facts, if we accumulate facts of all kinds, merely making sure that they are valid, we will slowly nibble away at the unknown. There is really no need for theories. But we now know that most facts—perhaps *all*—are expressions of a theory. Anthropologists, and particularly linguists, have proven that even naming an object "a chair," or "a man," is an expression of a world outlook which must be taken into consideration if the statement is to be understood correctly.

This is by no means a plea against detailed work. Every clash of issues eventually works itself down to small crucial experiments, which of course must be done as well and as carefully as possible, for ultimately the experimenter is the Supreme Court before which all theories are tested.

But because we know so little for certain about human beings, intuition, experience, wisdom and insight all become extremely important. Even a stupid man can understand an idea which is sufficiently embodied

in facts, but when there are few related facts only the innately perceptive man can know. Philosophies of human nature have been expounded by theologians, poets, dramatists, artists, statesmen, industrialists and many others. We should respect these theories almost as much as those of the psychologist, and use them as frameworks for criticism, for suggested experiments. The triumph of science is that it can take the innate wisdom of the great intuitors, correct it, test it, winnow it, and come out with more certain and reliable knowledge. When, after years of theorizing, debate and experiment, scientists arrive at the same conclusions that Rousseau or Shakespeare did, it is not actually the same. Then it was a theory; now it is new knowledge. And I remind you that we need a principle by which to select the correct one from among the various contradictory theories which have been offered. Who is to check them but the scientist, and on what basis if not that of empirical research?

We must pay special attention to the synoptic thinkers, the producers of theories of the whole man in his whole world. It is easy enough to develop a sound theory of the learning of nonsense syllables, or of rats running in mazes, or of the conditioning of the dog's salivary reflex. To integrate these miniature theories into the whole fabric of psychology is another matter. To relate them to love and hate, to growing and regressing, to happiness and pain, to courage and anxiety, exposes the weakness of nibbling away at the edges of reality, instead of making reconnaissance flights over the whole of it.

III

American psychology should be bolder, more creative; it should try to discover, not only to be cautious and careful in avoiding mistakes.

Why is it that there has never been a great, creative American psychologist? Our best men have been excellent scholars, systematizers and experimenters, but not great discoverers. All the great breakthroughs have come from Europe: all the brands of psychoanalysis, Freud, Adler, Jung, Rank, Fromm, Horney; all the Gestalt psychologists, Wertheimer, Koffka, Kohler, Lewin; the Rorschach test, Goldstein's organismic psychology. Even behaviorism, so specifically American, began with Pavlov.

I have been told that something very similar is true for the other sciences. In atomic physics, for example, Einstein, Bohr, Fermi and Szilard were all Europeans.

Why is American science so essentially conventional, so hostile to creativeness, to innovation, to unorthodoxy, to new ideas? Why are American psychologists characteristically appliers of other people's ideas? Why do they despise and attack the innovator for years, and then at last, when his idea has become more accustomed, seize upon it, make it conventional, and work it out in hundreds of experiments? As Picasso said, "First you invent something, and then they make it pretty."

I remember how saddened and irritated I was by an official report of a major committee of the American Psychological Association on the future of psychological science. The recommendations were principally methodological: how to be cautious, how to check, how to discover mistakes, how to validate, how to be accurate and precise. Hardly a word was mentioned about the need for creativeness, for new ideas, breaking out of the rut, taking a chance, encouraging uncertainty and exploration. It was all so much like the road maps given out at a gas station, that tell us how to make our way from known place to place. Not a word is given about the no-man's land where there are no street signs and paved roads; not a word about the pioneering and trail-breaking that are necessary before the maps can be made.

The fear seems to be that once we admit creativeness we may involve ourselves with all sorts of poets, artists, musicians and other questionable people who don't have a Ph.D. in psychology and are therefore clearly social climbers without any right or qualification to know anything about human nature.

IV

PSYCHOLOGY should be more problem-centered, and less absorbed with means or methods.

In Chapter 2 of my book, *Motivation and Personality*, I have considered this problem at length, and so will merely cite the general point: If you are primarily interested in doing what you can about important questions, then techniques become secondary. For example, if you propose to tackle the question, "What is love?" you will stick with the problem even though you are forced to improvise. In the early stages of exploration, you will have to be content with inexactness and uncertainty. If you demand exactness, elegance, and reliability, such a problem is unworkable, because the techniques now available are of little help. Those who insist on precision from the beginning therefore can never begin. All they can do is come in on the later stages of development of the problem.

Therefore, if science is identified with exactness, with quantifications, with precisely defined variables over which there is good control, all the first stages of work with any problem, when hunches, naturalistic observations, speculations and theories reign supreme, must be repudiated as "unscientific." Put even more bluntly, to define science primarily as method makes of it a senseless game or ritual. What is it a method for? If pertinence, goal and value are understressed, and the exclusive aim is validity and reliability, it is much like making the boast, "I don't know or care what I'm doing, but see how accurately I'm doing it."

The situation in American psychology, in which most researchers concentrate on doing well what they can, rather than seeking out what needs to be done, is largely due, I believe, to this mistaken notion of science.

V

PSYCHOLOGY ought to become more positive and less negative. It should have higher ceilings, and not be afraid of the loftier possibilities of the human being.

One major shortcoming of research psychology, and psychiatry as well, is its pessimistic, negative and limited conception of the full height to which the human being can attain. Partly because of this preconception, it has so far revealed many of man's shortcomings, weaknesses and ills, but few of his virtues, potentialities or higher aspirations. In the book to which I have referred I have made a number of positive suggestions for needed research.

This is not a call for optimism. Rather it is a demand for realism in the best sense of the word. It is ridiculous to identify realism with darkness, misery, pathology and breakdown, as so many contemporary novelists have done. Happiness is as real as unhappiness; gratification is as real as frustration; love is as real as hostility.

However, I want to stress the most important single example of this mistake, namely, the contrast between our knowledge of psychological sickness and our wholly inadequate attention to psychological health. I can understand this discrepancy, because my own efforts to study healthy people have taught me how difficult a task it is, ringed about with philosophical reefs of all sorts, particularly in the area of the theory of values. In addition, there are cultural, methodological and clinical problems. Yet it clearly calls for doing. We must know what men are like at their best; not only what they are, but also what they can become. The byproducts of such knowledge are incalculably important. My belief is that such a health-psychology will inevitably transform our deepest conceptions of human nature. It will wean us away from our almost universal habit of regarding normality as a special case of the abnormal, and teach us that instead the abnormal is a special case of the normal, and that psychological illness is primarily a struggle toward health.

Another aspect of this same mistaken preoccupation with the negative is the amount of time that has been spent on the defensive processes, on self-protectiveness, on safety and security, and on homeostatic processes. The easy implication is that life is a process of avoiding pain and of fighting unhappiness. But there is another set of motivations, the positive ones. A human being also tends to grow stronger, wiser, healthier, to actualize his potentialities, to be curious, to wonder, to be interested, to philosophize, to be creative, to enjoy. He does not only adjust; he also rebels.

It is perfectly true that we shrink within ourselves when something threatens. We try to avoid pain, and there is much pain in life for most people. Yet if life were simply and only an avoidance of pain, why would we not all cut our throats and thereby avoid pain forever? Clearly life has more to offer, and we should study this "something more."

VI

If all this is so, therapy should be taken out of the office and spread to many other areas of life. Furthermore, it should not only be more broadly used, but also more ambitiously defined to include the growth-fostering techniques.

Some of the more elementary psychotherapeutic techniques can be taught in simplified form to teachers, parents, ministers, doctors, and other laymen. Support, reassurance, acceptance, love, respect—all of these are therapeutic. We know also that many of the good life experiences are themselves therapeutic, such as the good marriage, good education, success at a job, friends, the ability to help others, creative work, and so on. All of these are basic medicine which should be studied carefully, and knowledge so gained should be widely taught.

In any case, the conception of therapy as the elimination of symptoms and illnesses is too limited. We must learn to think of it more as a technique for fostering general growth, for encouraging self-actualization. This means that many other techniques not now included under the head of psychotherapy will be shown to belong there. The meaning of therapy should be expanded to include all the growth-fostering techniques, particularly educational ones, and most particularly creative education in art, in play, and in all forms of expression that encourage creativeness, spontaneity, courage and integration.

VII

PSYCHOLOGY should study the depths of human nature as well as the surface behavior, the unconscious as well as the conscious.

I am aware that this may sound fantastic, yet the truth is that academic experimental psychology does not study the depths as it should, being preoccupied with what can be seen, touched or heard. The greatest single psychological discovery ever made was the discovery of unconscious motivations, yet the unconscious is still out of bounds for many research psychologists. Until recently, its study has been mostly the task of psychoanalysts, psychotherapists and psychiatrists.

The consequence, judging from the standard texts in general psychology, is a kind of half-psychology, in which human nature is presented, so to speak, "from middle C upward." This is like defining an iceberg as only that portion which can be seen above the waterline. The result is an "official" psychology which deals with rationality but not with irrationality, with the cognitive far more than with the conative and emotional, with adjustment to external reality far more than to internal reality, with the verbal, mathematical, logical and physical far more than with the archaic, the proverbial, the symbolic, the illogical, the fluid, the intuitive, the poetic—all that the psychoanalysts call "primary process."

Not only do our depths make trouble for us; this is also where our joys come from. If we go about the

world not knowing what goes on inside ourselves, unaware of what we are searching for, unconscious of the forces which largely determine our behavior, we are blind to the sources both of our ills and of our pleasures. This lack of understanding means a lack of control over our own fate.

VIII

ACADEMIC psychology is too exclusively Western.

It needs to draw on Eastern sources as well. It turns too much to the objective, the public, the outer, the behavioral, and should learn more about the subjective, the private, the inner, the meditative. Introspection, thrown out as a technique, should be brought back into psychological research.

American psychology is particularly behavioristic, concentrating on overt actions. This originates in a praiseworthy, though naive, effort to be "scientific." Of course it is the hope and goal of scientists to demonstrate, to prove, and to repeat the experiment in another laboratory. Yet we must face the hard fact that this is an ultimate rather than an immediate goal. By confining ourselves to the observation of external behavior, we overlook all sorts of human activities which do not show themselves externally in a simple form.

Behaviorism originated in a sensible reaction against anthropomorphizing animal psychology, but the pendulum has swung too far, and instead it has rodentomorphized human psychology, studying the person as if he were just a complicated white rat. It is indeed a mistake to attribute human motives to laboratory animals, but is it a mistake to attribute human motives to humans?

I should like to bring back introspection for another reason. We are discovering more and more, as we study personality in the depths rather than at the surface, that the deeper we penetrate the more universality we find. At men's deepest levels they seem to be more alike than different. Therefore, if the individual can touch these depths within himself, usually with the aid of a therapist, he discovers not only himself, but also the whole human spirit. The non-academic psychologists of the East have always known this; we in the West must learn it too.

IX

PSYCHOLOGISTS should study the end experiences as well as the means to ends—the pragmatic, the useful, and the purposive.

What does man live for? What makes living worthwhile? What experiences in life justify the pains of existence? We know that we reach the heights of living in moments of creation, of insight, of delight, of love-sex experience, of aesthetic experience, of mystical experience—the "peak experiences." Were it not for these, life would make no sense.

We must remember, too, that end-experiences need not be only the peak-experiences of life. We gain milder rewards in simple zest of living, in having fun,

in all the activities that are done for their own sake. A healthy organism enjoys just being. Our over-pragmatic psychology passes all this by.

X

PSYCHOLOGY should study the human being not just as passive clay, helplessly determined by outside forces. Man is, or should be, an active, autonomous, self-governing mover, chooser and center of his own life.

The so-called stimulus-response psychology has unintentionally created what might be called a Stimulus-Response man, passive, shaped, adjusting, learning. With him should be contrasted the creative, active man, who invents, makes decisions, accepts some stimuli and rejects others, who, in fact, creates his own stimuli. Posing this opposition may help in understanding why more and more psychologists are growing worried about the concept of "adjustment." Adjustment, whether to the culture, to other people, or to nature, essentially means being passive, letting oneself be shaped from the outside. It is trying to be what others want, instead of searching for one's real self. From this point of view, psychologists are increasingly beginning to criticize the conception of learning as a passive process.

XI

INTELLECTUALS tend to become absorbed with abstractions, words and concepts, and to forget the original real experience which is the beginning of all science. In psychology, this is a particular danger.

My own remedy for this is two-fold: first, to turn to the general-semanticists, who devote themselves specifically to this problem; and second, to look to the artists, whose particular task it is to experience freshly, to see—and to help us see—the world as it really is, not screened through a web of concepts, verbalisms, abstractions, categories and theories.

XII

THE lessons of Gestalt psychology and of organismic theory have not been fully integrated into psychology. The human being is an irreducible unit, at least as far as psychological research is concerned. Everything in him is related to everything else, in greater or lesser degree.

This has one important consequence. In his essential core, no human being is comparable with any

other. Therefore his ideals for himself, his path of growth, must also be unique. His goal must arise out of his own nature, and not be chosen by comparison or competition with others. Each man's task is to become the best himself. Joe Doakes must not try to be like Abraham Lincoln or Thomas Jefferson or any other model or hero. He must become the best Joe Doakes in the world. This he can do, and only this is necessary or possible. Here he has no competitors.

XIII

PSYCHOLOGISTS should devote more time to the intensive study of the single unique person, to balance their preoccupation with the generalized man and with generalized and abstracted capacities.

There is one great difference between psychological studies and those of other sciences. All other sciences really study similarities, which means abstracting. One white rat is as good as another; one atom is like another; one chemical is like another. The differences are not significant. Psychology too must abstract, but it has the special task, which belongs to no other science except anthropology, of studying uniqueness.

XIV

FINALLY, as we begin to know more about legitimate wants and needs for personal growth and self-fulfillment, that is, for psychological health, then we should set ourselves the task of creating the health-fostering culture.

This is, to my mind, no more difficult a task in principle than the making of the A-Bomb. Naturally we don't know enough to do a good job right now. But part of the ultimate task would be the acquisition of necessary knowledge, and to this there could be, theoretically, no objections.

Such an enterprise, when begun, will be the proof that psychology has matured enough to be fruitful, not in individual terms alone, but in terms of social betterment as well.

The foregoing will be a chapter in a book, now in preparation, to be entitled *Personal Problems and Psychological Frontiers*, edited by Dr. Johnson E. Fairchild, director of Adult Education and chairman of the Cooper Union Forum. The book will be brought out by Sheridan House.



MATHEMATICS AND POETRY

Thomas H. Jameson

New York University

A Common Substrate in Experience

I

IT has often been remarked, I am sure, that man is as much a "forgetting" creature as a remembering one, both processes being essential to the forward evolutionary motion of which he partakes. Let me use these two concepts as a starting point for an attempt to explore some of the deeper relations of poetry and mathematics, the language of science. Whatever divergence we arrive at in tracing the two from their roots and beginnings, we shall nevertheless take as our premise that man is *one* in his experience. Experience is unitary; it is all.

The human need for forgetting is both individual and collective. Ask the child, recently an infant, what sequence of muscular efforts he employed in his learning to crawl, stand and walk. He cannot say, and if he could it is probable that he would never have learned in the first place. The individual motions have long since been merged in a complex whole and can be performed separately only with difficulty. The memory of them, therefore, is of no possible use to him. Try explaining to persons of good intelligence what the conceptual stages were that resulted in our learning to count and you will find that they have trouble even in following you, so labored and circuitous a path does it seem to arrive at so simple a skill. Yet there was a time in the history of the race when between the fiveness of the human hand and the chance fiveness of any other collection of things there was no connection whatsoever. The pure abstraction *five* which may be used to bind pebbles, fingers, livestock, or anything else in the world into a special new category of experience was to become an instrument of control more potent than any other in the whole history of the race. By putting out of mind real digits, feet, cubits, and fathoms, and all the experiences associated with them, man made science possible.

The hard-won experience of counting has been packed off to "tables" where it can be readily com-

mitted to memory by the youngest of the tribe. Histories of science remind us that we have packed off a good deal more than number. We marvel afterwards how it is that we can say the words that describe the behavior of certain electric charges in the presence of so many turns of copper wire and *not hear* ourselves naming off the indomitable Italians, Frenchmen, Englishmen and Danes who made up as illustrious a crew as ever manned the Argo. Their quest was for the secret contained in a bit of yellow substance which the Greeks called "electron"; they were drawn together by mutual report, they ventured each his particular strength or skill, and together they won through to the prize. For us the whole great experience has been reduced to a formula, a few colorless symbols on a page; we have forgotten "in a moment" more than "... five-and-twenty centuries have wrought

Since Argo's shadow o'er wondering Neptune passed."¹

The above are illustrations of what Ernst Mach meant when he once wrote that "the function of science is, to replace experience" and that a "total disburdening of the mind" is characteristic of mathematics.² He wrote of the magical ease with which great masses of other people's experience may be lifted and ordered so that it must sometimes seem to the mathematician that it is not he but his paper and pencil which are the real possessors of the intelligence.

A similar magical effect, of course, is often ascribed to a page of verse by readers of poetry—less often perhaps by the poets themselves, who of all people must be least conscious of any disburdening of the mind. In both cases, poetry and mathematics, a manipulation of symbol is followed by a release of energy stored in the past, even for poetry, much of it being the energy of "other people." This and the fact that it is conveyed in forms not immediately recognizable—

¹ From the Laurence Binyon translation of Dante's *Paradiso*.

² In *The Science of Mechanics*, reprinted in *Readings in Philosophy of Science*, edited by Philip P. Wiener, N. Y., 1953.

the familiar in the strange, and the strange in the familiar—makes for an illusion of magic, though, if the truth be told, in neither case is it magic but, as our physics books tell us, work.¹

II

THESE preliminary remarks have brought us to our theme proper, the different manifestations of energy that we call poetry and mathematics and the common source of such energy—experience. An adequate explanation of the difference is to be sought for not in the realm of magic but of work. What then is the difference? One of the most useful distinctions that I know of occurs in the writings of Francis Bacon, though it requires certain modifications in view of the development of thought since his day. The passage actually concerns poetry and science, but since in the Baconian scheme science and mathematics are equally the products of Reason, it will lose none of its usefulness as a starting point of discussion. "Poetry," wrote Bacon, "was ever thought to have some participation of divineness, because it doth raise and erect the mind, by submitting the shows of things to the desires of the mind; whereas reason doth buckle and bow the mind unto the nature of things."² Judging by their effects, then, we may say that poetry and science differ to the extent that they reflect different uses by the mind of "the shows" of the world. Bacon's distinction between shows and "real" nature is one that we no longer make, nor would he himself have made it if he had happened to live after the time of Berkeley and Hume. Nature is for us at most "postulated" nature, for whatever deeper "reality" may reside in things around us, it is generally agreed that knowledge of that reality (except such knowledge as may be already "there") reaches the human nervous system in the same coded form—sensation—as do the surface shows. Making these corrections, then, may we not construe Bacon's observation as telling us that the difference between poetry and science is the difference between what we should like to get from the world and what it is possible to get? Poetry, and art in general, manipulate the shows to accord with desire. Science forces the mind to choose among the shows those that have a certain recurrent stability, irrespective of desire. It becomes clearer, at any rate, why our deepest wants appear to be embodied in poetry, our deepest knowledge in mathematics.³

¹ To sav with Mach that memory "is not really work" is to flout the law of conservation of energy and encourage a needless reverence for the mere mechanical advantages of human thought, the latest of which is the electronic computer.

² *The Works of Francis Bacon*, ed. Spedding (Boston 1861-70) VI, p. 203.

³ How often is the claim for a superior "knowledge" conveyed by poetry not found to rest on memorably phrased messages of renunciation or relinquishment of desire, and their obverse, acceptances of pain? Whether there is a resonance of the human spirit that comes from attunement of its fluctuations with the positive forward motion of human knowledge, now accelerating, now decelerating, is deep matter for study. At present science may be providing us with more knowledge of "the possible" than we can comfortably use.

By what means does the stuff of the world get itself translated into such totally different forms as lyric verse and mathematical equations? The answer, I think the reader will agree, is one for physiology and psychology to provide in the long and laborious years to come—with little help, as F. S. C. Northrop pointed out some time ago, from devotees of either pure poetry or pure science.⁴ For the answer is to be found in the "epistemic" world of concept, a world of "interpolations" lying somewhere between our motor and sensory nerves or, as Mach would have it (though perhaps he showed his bias by forgetting "feeling-symbols"), of "thought-symbols for compound sensation." With these symbols we forge the first links of a chain of response to the sea of matter in and around us. With this tight, electrically driven machinery we launch future poetry and science upon the world. On the present occasion we must be content to show that such "translations" of experience do emerge; how they emerge we must leave to others to explain.

OUR examples will be two in number: one, an example of an effort to impress on the mind certain shapes postulated of the world (leaving the question of where the world "is" as ambiguous as we found it); the other, an effort to impress on the world certain shapes of feeling. Appropriately enough, the burden of each example will be sound, the carrier of the human voice. From earliest times sound has been the instrument par excellence for linking matter to matter. Every contour of the planet testifies to the activity of the "visionary power" that

"Attends the motions of the viewless winds,
Embodied in the mystery of words:

There, darkness make abode, and all the host
Of shadowy things work endless changes . . ."

Inserted "between" certain sequences of sensation felt by men, sequences already arranged in class, sub-class and further sub-class, there arose in time (and in that time nations rose, flourished and went under) the concept of disturbances of something called air molecules. Late in the seventeenth century the visionary Newton made an approximation of their velocity. It is contained in the following expanded formula:

$$v = \frac{\sqrt{1.4 \times 76 \times 13.6 \times 980}}{0.00129}$$

This is our first translation of experience.

The equation tells us that the velocity of sound in air is determined by various relations of density and heat capacity of the gas, air, and that is *all* it tells us. In the appropriate Scholium in the *Principia*, it is

⁴ In an article appearing in *Furioso* in 1941 Northrop recommended that poets, at least, learn the difference between the two kinds of concept, theoretic and aesthetic, and cease trying to appropriate the entire field for inclusion in a "higher reality" bearing the label of poetry. By correlating rather than appropriating he felt that poets might establish themselves both as "handmaidens" (interpreters) of science and as independent toilers in the realms of the spirit. "An epistemic correlation . . . etc." ("The Function and Future of Poetry," *Furioso*, I, 4, p. 73). The thesis was much elaborated in his better known *The Meeting of East and West*.

true, Newton remarks that we will find "these things" confirmed by our experience with different climates and seasons, but of such experience the equation contains no hint. Nor does it contain any hint of other experience so old as to linger in the modern and seventeenth century mind only as vague memories: of elemental Water raining down from the Air, the Father, (a cubic centimeter of it, the equation reminds us, is now the standard measure of weight, an emblem of elemental Force), Water rushing at ever-increasing speed to the center of the earth (if it were not impeded); of the mother herself, the Earth Mother!

"... magna deum mater materque ferarum
et nostri genetrix . . ."

Now water in league with mercury, says physics, determines the weight of air, of air under certain conditions of heat. But whence heat? The very word velocity is but a sound to denote a measure of space that terrestrial objects pass over while the source of all Fire, the Sun God himself, is keeping certain appointments with his distant peers.

The doctrine of the Elements in early Greek science, we are told by no less a person than the late George Sarton, was "nonsense." In our present mood of "epistemic" correlation might we not prefer to call it, not nonsense, not even antiquated science—(not with the evidence so plainly before us of what is *behind* the modern equation)—but rather the other side of a coin, a coin whose totality is nothing less than experience. It is, as we know, fashionable today to disparage Greek science as having been of benefit only to property owners, but—if the reader will pardon a bit of humor—the Elements are the property of all of us. Nonsense the doctrine may have been, in a limited modern sense, but we can only marvel at the persistence with which more enlightened centuries have held to such headlands of certainty in the world of eternal flux, traversing continents for occurrences of sufficient fixity to serve as measures.*

It is a different atmosphere entirely, of course, that we breathe in the *Principia*, Newton being among those who had cast their lot with number. If a successful poem may be said to celebrate man's triumph over the shows of the world, it is equally true that a successful equation celebrates his triumph over his own mind and its inveterate anthropomorphism. Experience *must* be replaced (in Mach's phrase) if the mathematical magic of the familiar in the strange and the strange in the familiar is, mathematically speaking, "to work." Not for Newton, then, the excitement that arises from images of desire. Not in the *Principia* at least that powerful allied excitement that seems amply justified by Nature herself. This latter can be expressed by such runic devices as that of the Roman

poet Lucretius and is the more potent in that it derives neither from poetry nor mathematics but from something between. What a transformation is wrought in matter by number through the simple expedient of adding a single letter to the Latin adjective *igneus* and making it *ligneus*! Thus Lucretius, but the promptings to such excitement are by no means absent even today. Confronted with certain magic regularities in the table of atomic weights, it would be strange if one did not occasionally experience a Pythagorean awe at the visible proof of Number working its alchemical changes in Matter.

Such indulgence has no place in our more scientific moments, however, for historians of science to a man have made it amply clear to us that science as we know it today was not possible until men found means to do their thinking entirely without pictures, in mathematical notations which bear no relation to anything in the world outside themselves. Newton, therefore, much as he may have been concerned—as a man—to reduce the shows of the world to an order which would testify to the glorious workmanship of God, as a scientist cast his lot with number. Everywhere in the *Principia* we read the same lesson, not excepting the Propositions and Corollaries devoted to the velocities of pulses in elastic media. One starts with mathematical theorems derived from quantities discovered "in" Nature (with pendulum oscillations in this case); one puts these quantities into strictly mathematical relationship with other quantities (oscillations translated into circular motion); one arrives at mathematical conclusions (linear velocity); and then, but only if one chooses, one looks for confirmation in new observations and experience. (As Mach makes clear in an analogous example, this is an indifferent matter, for though we can measure the velocity of sound empirically, we have yet to measure or even observe the motion of Newton's "tremulous" air particles.)

A certain matter deserves to be returned to briefly before we go on. If, as so often happens, men actually find mathematical correspondence in nature which match the postulations in their minds and if the results in the visible world are as great and lasting as they seem, why cannot we be content with the popular notion of science as that activity which seeks to "control nature?" Why suggest, with Francis Bacon, that the significant control is control of the mind, a control exercised by Reason acting as a kind of deputy of "the nature of things?" The answer to this question, I believe, must be no less ambiguous than all questions that relate to the human brain itself. The brain is the place where mind meets matter: this seems generally agreed. Mind moves—matter moves with it. Or matter moves—so does mind. Which controls the other depends on how you read the brain. In the impossibly complicated world that we have inherited today we feel less compelled than ever before to make a choice between the *a priori* of the two rival closed-thought systems of the past: "mind is matter" or

* So much is made in certain quarters of the superior exactness of the physical sciences that it is worth reminding ourselves once again that such exactness is only relative. For scientific purposes objects stand still at carefully chosen moments; that is, they stand "still enough."

"mind is not matter." Whichever it "is" we are not likely to know until we know more precisely *what* we mean by mind and *what* we mean by matter. Fortunately, the scientific temper thrives on uncertainty.

IN this spirit, then, we shall approach the second of our illustrations. Sound, as we have seen, can be directly related to the disturbances of particles of air. But what of human *value*, in all its immense range from trivial to sublime, that for which sound is no more than a carrier, as radio waves are carriers in turn for sound itself? (Will it be by such things as amplitude that we may some day distinguish mind from mere energy?)¹ Our second example will be a very incomplete celebration indeed of mind over matter; yet celebration it is, a magnificent one if we take into account the odds against us, and the author. In the series of poems called *Four Quartets* the contemporary poet T. S. Eliot has turned once again to the four primal elements as he declares the plight of the human spirit in a world in which it does not always feel at home. They are his acknowledged landmarks in a Heraclitan world of flux. The passage below supplies the concluding strains to the first quartet, a piece whose theme is Air:

"Words move, music moves
Only in time; but that which is only living
Can only die. Words, after speech, reach
Into the silence. Only by the form, the pattern,
Can words or music reach
The stillness, as a Chinese jar still
Moves perpetually in its stillness.
Not the stillness of the violin, while the note lasts,
Not that only, but the co-existence,
Or say that the end precedes the beginning,
And the end and the beginning were always there
Before the beginning and after the end.
And all is always now. Words strain,
Crack and sometimes break, under the burden,
Under the tension, slip, slide, perish,
Decay with imprecision, will not stay in place,
Will not stay still. Shrieking voices
Scolding, mocking, or merely chattering,
Always assail them. The Word in the desert
Is most attacked by voices of temptation,
The crying shadow in the funeral dance,
The loud lament of the disconsolate chimera."

What shapes of feeling are here impressed on eternal flux? Up to the point where words "strain, crack and sometimes break," clearly they are the shapes that are associated in the arts, particularly in music and painting, with the filling of space, forms whose strict mathematical counterparts are the curves, lines and centerings of geometry. A special effort is made

¹ The relationship between the rigorous necessities imposed by nature's laws upon musical form and the development of artistic intent has been indicated by Jeans in his *Science and Music*. His discussion suggests that there may be something multi-dimensional about the musical use of acoustics which gives the artist latitude.—Ed. Note.

just before the breaking of words to impress the forms more deeply by recourse to the language of mysticism, which also employs geometric forms to fill space.

The whole passage is a most interesting converse to the Newtonian velocity equation given earlier, and only partly because of the evident refusal, halfway through it, of feeling to accept and compound with the shapes to be impressed. We are reminded that it is as much in the nature of the poetic "celebration" to show some of the struggle and pain that went into the victory as it is for mathematics not to. The matter will be returned to; for the moment we shall suggest that the revolt of feeling is to be laid to something else than a sudden realization on the poet's part that the formulae of mystic expression were not adequate to his task. Certainly it would be the first time in the history of literature that the complaint was made against incantational verse that the words would not "stay in place," when the opposite is perhaps their special attribute!

The language of mysticism is one of the chief characteristics of the sequels to the passage under consideration. The *Four Quartets* is a poem about the incommensurability of spirit and matter, and as such it avails itself of all the diagrammatic "helps to understanding" traditional in works of that scope.² The Center of Perfection to which all else aspires, itself unmoving and undesiring but pregnant with infinite potentialities of being represented by concentric circles; again, the infinite points which make up a circle, any one of which may be both a beginning and an end; certain other points lying outside the circle ("outside time"), hence appearing to have no before or after, but—for all their sudden illumination—probably representing no more than projections of points on the circle: these are among the chief means by which the poem works out its meaning. They are as much the emergent poetic "matter" of the poem going under the name of *Four Quartets* as were Earth, Air, Water and Fire in Newton's formula the disembodied memories of physical matter. In short, they represent the real achievement of the poem: what previously were mere motions "felt along the blood" have emerged into the established channels of human communication as no longer entirely *nameless* experience (though names, other than mathematical, are lacking). In the Newtonian equation, on the other hand, names heavy with meaning, meaning derived from experience, have dropped out of those same channels, their places taken by tokens of an entirely different sort of experience.

Let us return before we conclude to the beautiful images in the quoted passage and see how the revolt which followed was bred in the very shapes that gave rise to them. A jar and a strain of music are sudden and poignant neither because they suggest geometry nor in spite of suggesting it. There are no shapes that

² The current issues of *The Jacob Boehme Society Quarterly* are devoted to reproductions of such diagrams taken from Freher's *Paradoxa*.

belong exclusively to mathematics; all human concepts, whether the affective or the intellectual kind, are creations of human beings, assignments to sensation of required *work*. Even number, as we learned from our formula, can bear its load of feeling—if we but turn the coin. The images are so poignant and beautiful because of their irrevocable association with purity.* Elsewhere in the *Quartets* Eliot introduces facile little meters, vehicles for a somewhat tormented thought, only to reject them a moment later with faint mockery in favor of a more “natural” style, “an easy commerce of the old and new,” but in our passage he appears to have been taken quite unawares. When feeling is not in order, it all too often happens—we know it to our shame—that it chooses words of the wrong shape. Eliot’s choice of pure line and curve is rewarded with a Miltonic chaos of shapes, which slip, slide, perish as they

“ . . . to Battel bring
Their embryo Atoms.”

The atoms, however, are atoms of feeling, and the battle is joined at a level below words. Order in feeling must be restored before the desired shapes may be put to use.

THIS is not the place for detailed exegesis of a particular poet’s thought, even if it were necessary to our theme. I content myself with a single rhetorical question: Is there a reader of Milton’s hymn *On the Morning Of Christ’s Nativity* who does not confess to having experienced wonder at the boldness of the young Milton in surrounding with such fair forms the false gods—particularly Apollo—he was banishing on Christmas morning from places of worship and revelation? I cannot feel it an accident that Eliot chose to merge his cause with that of the predecessor who began his more saintly career with an undergraduate poem of such great distinction. Echoes of the Hymn are plain for all who can detect them in the concluding lines of the passage we have been discussing, but far outweighing them in importance to my way of thinking is the unspoken reference which tells

* Who is to say that the primal geometry lesson, strength for handling, cleanness to the touch, was not a neurological one?

us that our poet, in the very act of fashioning these images of still beauty, is recalling that his voice too had done its share of “scolding, mocking, or merely chattering”; had in fact (in Milton’s words) “run through the *arched* roof in words deceiving.” In the desert of the Wasteland he too had contributed to the hollow shriek and loud lament of unbelief. He had been excessively praised for it too (for things “Which once you took for exercise of virtue”). Here, then, if anywhere, at the end of his first quartet, whose predominant instrument is Intellect, pride of intellect should be muted. As the shapes themselves rise and gather meaning, so too the awareness by the poet that he has not yet, nor so easily, earned the right to handle things hallowed by ancient usage.

“We had the experience but missed the meaning,
And approach to the meaning restores the experience
In a different form, beyond any meaning
We can assign to happiness.”

Fortunately the voices now assailing Eliot both as an artist and a believer are not something completely new; they have been heard in the past by others greater than himself,

“men whom one cannot hope
To emulate—but there is no competition—
There is only the fight to recover what has been lost
And found and lost again and again . . .”

“TO apprehend/The point of intersection of the timeless/With time, is an occupation for the saint.” The poet’s occupation, however, is to launch speech into the silence. All four *Quartets* with mounting intensity send imagery of air, earth, water, and fire into the silence. They send it *after* speech. This is the triumph of the *Four Quartets*. If the day ever comes when, with the combined instruments of micro-biology, physics and psychology, men succeed in finding a place for “mind” in the vast cycle of entropy that seems to make up the universe—perhaps expressing their findings in the abstract language of mathematics—if that day arrives and English is still a spoken language, they may not have forgotten the sound of a violin as rendered by an old poet, the still motion of a Chinese jar.



THE CONTRIBUTION OF CHINESE ORGANICISM TO EUROPEAN THOUGHT

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Editor's Note: The following is an extract taken from Volume II of *Science and Civilization in China*, by Joseph Needham, pp. 498-505, through kind permission of the author and publishers, the Cambridge University Press. A review of this and the preceding volume will be found on page 46. The text of this extract is precisely as it appears in the original, except that those footnotes which are exclusively bibliographical are omitted, since the reader is not supplied with the bibliography itself. We are also obliged to forego representing the beautiful Chinese characters which are dotted through the volume in the footnotes as explication for the benefit of the reader of Chinese and a decorative touch for the uninformed Westerner.

IN the Newtonian age, mechanical materialism (even if ornamentally presented, as in deism) would still do, but as the 19th century began, the progress of science itself began to break its bounds. Hence the Hegelian dialectic and all that followed. The world of Darwin, Freud and Einstein was almost as different from that of the 17th century as it in turn had been from what had gone before. Hence the flowing tide which manifested itself as philosophies of *organism*, whether of Marx and Engels with their integrative levels, or of Lloyd Morgan and Smuts with their emergent evolution, or of the biologists for whom classical mechanism and vitalism are no longer a live issue, or of Whitehead himself and the full organic view of the world. If these ideas are traced backwards in the thought of Europe they lead to Leibniz, and then they seem to disappear. What we have now to discuss is whether that is precisely because his own, the first, great attempt at a synthesis which should surmount the dichotomy of *either* theological vitalist idealism *or* mechanical materialism, was strongly stimulated by, if not indeed derived from, the organic world-outlook which we have found to be characteristically Chinese.

This is a great theme, which deserves better justice than can be done it within the framework of such a book as this. It would be difficult without an *ad hoc* investigation to attempt even an estimate of how much stimulus Leibniz received from Chinese philosophy, and such an investigation would not be easy because he was so unsystematic a writer, and so much of his

Leibniz as a Link Between East and West

writing remains only in the form of correspondence and fragments, some apparently still only in manuscript. But something can be said.

Carr tells us that in Leibniz's own account he wanted a realism, but not a mechanical one. Against the Cartesian view of the world as a vast machine, Leibniz proposed the alternative view of it as a vast living organism, every part of which was also an organism. This was the picture finally presented (in 1714, at the very end of his life) in the short but brilliant treatise posthumously published, the *Monadology*. These monads of which he considered the world to be composed were indissoluble organisms participating as parts of higher organisms. There were different levels of monads. It might almost be said that the monads were the first appearance of organisms upon the stage of occidental philosophy.¹ The hierarchy of monads and their 'pre-established harmony' resembled the innumerable individual manifestations of the Neo-Confucian Li in every pattern and organism. Each monad mirrored the universe like the nodes of Indra's Net.² By the aid of this hierarchial universe Leibniz hoped to overcome the antinomy between theological vitalism on the one hand and mechanical materialism on the other. If he was the first of a long line of thinkers to feel deep dissatisfaction with this alleged 'either-or,' was it perhaps the Neo-Confucian synthesis which hinted to him a more excellent way?

One has no difficulty in finding echoes of Chinese thought in his philosophy. When he says 'Every portion of matter may be conceived of as a garden full of plants or a pond full of fish; but every stem of a plant, every limb of an animal, and every drop of sap or blood is also such a garden or pond,' we feel that here is Buddhist speculation seen through a Neo-Confucian glass, yet meeting (*mirabile dictu*) with the experimental verifications seen through the microscope by Leeuwenhoek and Swammerdam, verifica-

¹ It is at first sight disturbing to find that monads are defined as without parts, but Leibniz used the word 'parts' in a rather special way. He refers to sand grains in a heap of sand as 'parts,' thus defining a part as an unorganized member of a non-organismic aggregate, and says 'a thing which has parts is not a unity.'

² As for the ancient metaphor, cf. the study of Pettazzoni on the bodies of gods covered with eyes.

tions of which Leibniz knew well and to which he admiringly refers.¹

When Leibniz speaks of the difference between machines and organisms as lying in the fact that every constituent monad of the organism is somehow alive and cooperating in a harmony of wills, we are irresistibly reminded of that 'harmony of wills' which we noted (p. 283) as characteristic of the Chinese system of 'correlative thinking' in which the whole universe in all its parts spontaneously cooperates without direction or mechanical impulsion. One monad, as Latta puts it, influences another only ideally (i.e. in a manner of speaking), not *ab extra*, but through inner pre-established conformity or harmony. Such words would most perfectly apply to the type of relations between things and events conceived in the Chinese system of correlative thought, where everything happens according to plan, yet nothing is the mechanical cause of anything else. Leibniz's pre-established harmony, a doctrine which was really an effort to solve the body-mind problem stated in the imperfect terms of the 17th century, has not lasted as such, but one can understand its place in an organicism of that date, and its congruency with traditional Chinese thought is too striking to be overlooked. One might well refer here to the vital passage from Tung Chung-Shu (2nd century) quoted above (p. 281), in which the comparison is made between causation as conceived in the universe of correlative thought, and the resonance of two musical instruments at some distance from one another. Eighteen centuries later Leibniz has recourse to a somewhat similar analogy when he emphasizes an experiment made by his friend Huygens, who attached two or more pendulums to the same piece of wood and found that if originally out of step they could come before long to swing in time with one another. The transmission of vibrations through the wood was not as unknown to Leibniz as the transmission of the sound-waves had been to Tung Chung-Shu, but it is rather striking that both should have employed a somewhat similar analogy to indicate their ideas of the method of working of an organic universe.

YET another echo of Chinese thought may be sensed in the passage where Leibniz says: 'There is neither absolute birth or complete death in the precise meaning of the separation of soul and body. What we call births are developments and unfoldings, and what we call deaths are foldings and shrinkages.' How many times have we not heard the Taoists talking of dissipation and condensation, and saying that there is no real creation or destruction, only densification and rarefaction (cf. pp. 40, 76, 107, 369). In Leibniz the processes are reversed, so that the old thought, which was really a naturalistic explanation of corporealisation and decorporealisation, joins hands with the new

microscopical discoveries of Malpighi and Swammerdam on early embryonic development, and hence with the great debate about preformation versus epigenesis. In this connection we shall not forget the term *chi* which Chuang Tzu and others (pp. 43, 78, 469, 470) used to mean the 'germs' of things.

It is indeed fortunate that we possess the considered opinions of Leibniz himself on Chinese philosophy. In +1701 two books became available, written by a 'dissenting' Jesuit, i.e. a Jesuit who did not share the attitude of most of his colleagues towards Chinese thought and ceremonies; and a Franciscan. The question was very complex. Fr. Ricci and most of his followers, going by the sense of the classical texts themselves, had concluded that the ancient Chinese expression *Shang Ti* (the Ruler Above) could be used as a translation for the God of the Christians, that the *kuei shen* or *thien shen* could be used for angels, and that *ling hun* could be used for soul. But, of course, as we have seen, the first of these conceptions had long lost its original anthropomorphic character, and the Neo-Confucians had made it metaphorical for *Li*. Similarly, the Neo-Confucians interpreted the *kuei shen* as natural causes, and considered the *hun* soul perishable. The texts thus said one thing and the Neo-Confucian commentaries said something quite different. Fr. Ricci and (at first) the majority held to the texts, but Fr. Nicholas Longobardi (the Jesuit) and Fr. Antoine de Ste Marie (the Franciscan) thought it better to accept the commentaries. In the first case Chinese thought needed only a minimum of revealed religion to assume the status of Catholic Christianity; in the second China was a land of atheists and agnostics. We can see now that to a large extent Ricci was right, and if the Jesuits had persisted in interpreting the ancient texts along these lines ultimate historical researches would have justified them. But Longobardi was equally right in his estimate of Neo-Confucianism.² The book of Longobardi was entitled *Traite sur Quelques Points de la Religion des Chinois*, and that of de Ste. Marie *Traite sur Quelques Points Importants de la Mission de la Chine*. The first was concerned rather with doctrine, the second with ceremonial and usages.³ Both give a very vivid picture of the anxious discussion which went on among missionaries and scholars in China. But the remarkable thing is that we have Leibniz's marginal annotations on both, printed in an edition of his miscellaneous papers by Kortholt in 1735. This material is followed by a long letter from Leibniz to de Remond, who was then Counsellor to the Regent (the Duke of Orleans) and Chief of Protocol, written about a year before

² These problems put the European theologians in a dreadful fix. If Ricci was right, the natural religion of the Chinese was not in need of revelation and grace. If Longobardi was right, the argument from universal consent was shattered. And, worse, the interdependence of morality and religion fell to the ground, since this people without religion had the reputation of being the best moralists in the world. Cf. Pascal, *Pensees*, vol. 2, p. 70.

³ Of course there were all kinds of political and other intrigues behind this and related controversies.

¹ As an indication of the influence of Leibniz's thought it may be mentioned that after the actual discovery of living cells by Schleiden and Schwann in 1839, they were referred to by the great physiologist Johannes Müller as 'organic monads.'

his death in 1716, in which he takes up many aspects of Chinese thought.¹ While he defends, in general, the 'Jesuit' view, i.e. that of Ricci—and his marginal notes on Longobardi and de Ste. Marie are all critical, sometimes amusingly and trenchantly so—it can easily be seen that he has long been much stimulated by Chinese thought, and that he has derived a great deal more from it than simply a conviction of its congruency with Christian philosophy.

Longobardi makes great complaint that the Chinese recognized no 'spiritual substances' as distinct from matter, i.e. no God, no angels, no reasonable soul, but Leibniz, seeking for a naturalism whence an immanent God would not be excluded, finds this universal association of the material component with the spiritual (organisational) component perfectly justifiable. Longobardi objects to the way in which the Chinese make the 'physical principle' of the universe in some way the same as the 'moral principle' of human virtue and other 'spiritual' things (i.e. deriving thus the highest human and social values from roots in the non-human, even non-living, world), but Leibniz is much attracted by it. Longobardi, having (perhaps wrongly) interpreted the expression *thai hsü* as referring to space, Leibniz says, 'One must conceive of space, not as a substance with parts, but as the order of things, in that they are considered as existing together (in a pattern), and as proceeding from the immensity of God, in that all things at every moment depend on it.' Later, Leibniz says, regarding Neo-Confucian naturalism, 'Thus the Chinese, far from being blameworthy in the matter, merit praise for believing that things come into being because of natural predispositions, and by a *pre-established order*. Chance has nothing to do with it, and to speak of chance seems to be introducing something which is not in the Chinese texts.' Here Leibniz put his finger on a very fundamental point. Longobardi repeatedly says that on the Chinese world-view, the universe has come into being by chance.² He says this because he is unable to imagine any kind of materialism or naturalism other than the Lucretian-Cartesian mechanical materialism which, with its chance clash of atoms, was one of the two polar opposites of European thought. But Leibniz is beginning to see that there could be a naturalism which is not mechanical, but (as later men would say) organic or dialectical.

Leibniz was better informed than some later European sinologists. Thus he says, 'The Li is called the natural rule of Heaven, because it is by its operation that all things are governed by weight and measure

conformably with their estates. This rule of Heaven is called Tien Tao.' And for a closing passage, one may instance the prophetic statement where he hints that the discoveries of modern science were more congruent with Neo-Confucian organic naturalism than with the spiritualism of Europe:

"Thus we may applaud the modern Chinese³ interpreters when they reduce the government of Heaven to natural causes, and when they differ from the ignorant populace, which is always on the look-out for supernatural (or rather supra-corporeal) miracles, and Spirits like *Deus ex machina*. And we shall be able to enlighten them further on these matters by informing them of the new discoveries of Europe, which have furnished almost mathematical reasons for many of the great marvels of Nature, and have made known the true systems of the macrocosm and the microcosm."

IT is not, of course, to be suggested that the stimulus of Chinese organicism was the only one which led Leibniz to his new philosophy. For example, he himself found points of contact between his own position and that of the Cambridge Platonists,⁴ a school of theologians and philosophers who had taught and written in the middle decades of the 17th century. Such men as Benjamin Whichcote, Henry More, and Ralph Cudworth, whose inspiration had been drawn from Plotinus no less than the *Theologica Platonica* of Marsilio Ficino and the Florentine Academy, stood in sharpest opposition to the rising influence of mathematical mechanism and materialism in the age of Bacon, Descartes, and Hobbes. It was the 'inorganic' world which gave to modern natural science its first triumphs, but the Cambridge Platonists, and their biological friends such as John Ray and Nehemiah Grew, could not, as it were, agree to forget for a while the problems of organic form in living things. Thus Cudworth believed that if Nature was to be coherent and intelligible it could be explained neither by the random movements of matter in space, nor by successions of arbitrary and incalculable acts of God. Together with his Cambridge colleagues, therefore, he developed a philosophy of science which came very close to being organic in the modern sense. Nature as a whole was 'plastic,' 'spermatical' or 'vital,' not mechanical. Each individual thing had an indwelling formative organising 'plastic nature,' the unconscious deputy of God within it. As Cassirer has well said; for Cudworth, all events in the universe depended not on forces operating from without, but on formative principles acting from within (how strangely Chinese the doctrine sounds). Cudworth himself wrote:

"Wherefore since neither all things are produced fortuitously or by the unguided Mechanism of Matter,

¹ Bernard-Maitre, Merkel and Lach have referred to this paper and quoted from it, but without elucidating its importance in the history of philosophy.

² They imagine that from the primal matter *Li* (a misunderstanding of course), air (*chhi*) came forth naturally and by chance . . . ; to which Leibniz's marginal note is 'Why? It might have come forth by reason.' The misunderstanding about *Li* and *Chhi* is put right by Leibniz when he says 'The subject of all generations and corruptions (alternately) assuming and divesting itself of diverse qualities or accidental forms . . . is not the *Li*, but rather the protogenous Air (*chhi*) in which the *Li* produces the primitive Entelechies, or substantial operative virtues which are the constitutive principle of spirits.'

³ Notice that he expressly says the 'modern' Chinese, indicating that he has the Neo-Confucian philosophical commentators in view, and not the writers of the ancient texts.

⁴ As he acknowledged in (for instance) his *Consideration sur les Principes de Vie et sur les Natures Plastiques* (Philos. Schriften, ed. Gerhardt, vol. 6, p. 544). Gerhardt, vol. 6, p. 544).

nor God himself may reasonably be thought to do all things Immediately and Miraculously, it may well be concluded, that there is a *Plastick Nature* under him, which as an Inferior and Subordinate Instrument doth drudgingly execute that Part of his Providence which consists in the Regular and Orderly Motion of Matter; yet so as there is also besides this a Higher Providence to be acknowledged, which presiding over it doth often supply the Defects of it, and sometimes overrule it; forasmuch as this *Plastick Nature* cannot act Electively or with Discretion."

Modern biologists find the organicism of the Cambridge Platonists attractive.¹ A experimentalist acquainted with the strange limitations as well as the wonderful capacities of specific morphogenetic processes can indeed appreciate their realisation of the fact that 'the plastic nature cannot act electively or with discretion' beyond a certain point. The Cambridge philosophers speculated that plastic natures would not only account for the laws of motion which the physicists and mechanists were establishing, but would 'extend further to the regular disposal of matter in the formation of plants and animals and other things in order to that apt coherent frame and harmony of the whole universe.'

The Cambridge thinkers wanted understanding and contemplation of Nature, not control over it; they sought synthesis, not analysis. But their relevance to the present argument depends on how far they ever freed themselves from the animism of the Neo-Platonists. Although the plastic nature was 'such a thing as doth not know, but only do . . .',² it was also often spoken of as an 'inward and living soul' in the material object.³ With all their biological insight, sadly lacking otherwise in the early Newtonian period, the Cambridge divines and naturalists remained fundamentally vitalist, and the substitution of archæi for souls did not really help.⁴ Spiritualism had been ingrained for centuries in Europe, as we saw from the fortunes of the macrocosm-microcosm analogy there. Confronted with a mathematised physical universe, it had either to retire into the fastnesses of ecclesiastical authority, or (more nobly) to send the rational theologians into a counter-attack in which vitalism was opposed to mathematics. Yet in the 17th century the

only path truly leading beyond Descartes (and his apparently irretrievable bifurcation of Nature) did not turn away from mathematics, it passed directly through its midst; this was the path which Leibniz took. It could only have been taken in the light of an organicism from which every animistic residue, every component other than the pure organising relations themselves, had disappeared. Perhaps Neo-Confucian Li showed the way for the purification of Neo-Platonic plastic nature.

IN a word, therefore, I propose for further examination⁵ the view that Europe owes to Chinese organic naturalism, based originally on a system of 'correlative thinking,' brought already to brilliant statement in the Taoist philosophers of the 3rd century, and systematised in the Neo-Confucian thinkers of the +12th, a deeply important stimulus, if it was no more, in the synthetic efforts which began in the 17th century to overcome the European antinomy between theological vitalism and mechanical materialism.⁶ The great triumphs of early 'modern' natural science were possible on the assumption of a mechanical universe—perhaps this was indispensable for them—but the time was to come when the growth of knowledge necessitated the adoption of a more organic philosophy no less naturalistic than atomic materialism. That was the time of Darwin, Frazer, Pasteur, Freud, Spemann, Planck and Einstein. When it came, a line of philosophical thinkers was found to have prepared the way—from Whitehead back to Engels and Hegel, from Hegel to Leibniz—and then perhaps the inspiration was not European at all.⁷ Perhaps the theoretical foundations of the most modern 'European' natural science owe more to men such as Chuang Chou, Chou Tun-I and Chu Hsi than the world has yet realised.

⁵ The assessment of the extent to which Neo-Confucian philosophy directly influenced Leibniz will involve detailed biographical researches. If it should be considered, as it often now is, that all the essentials of his system were worked out in the *Discourse on Metaphysics* (written in the winter of 1685-6), the terminology of monads being alone missing; then this was accomplished in the year before he read the *Confucius Sinarum Philosophus*. It was not till 1689 that during his six months' stay in Rome, Leibniz established those close relations with the Jesuits of the China Mission which so long afterwards continued. But his interest in China then dated back more than twenty years, to the early days at Nuremberg when he had read Spizel and Kircher, and worked on the 'project of a universal character.' Before accepting the view (suggested, for instance, by Mrs. Martha Kneale in private correspondence) that Leibniz's organic philosophy was developed largely under the influence of Spinoza, and that the Chinese ideas were taken up by him only as an unexpected and extraordinary confirmation of his own thought, we should know more about his contacts during the four years he spent in Paris before his call to the Librarianship at Hanover came to him in 1676. Could he not have been personally acquainted there or elsewhere with Jesuit translators? Couplet returned from China in 1682.

⁶ Graf has drawn attention to similarities between Chu Hsi and Spinoza. Kant's categorical imperative has a remarkably Mencian ring. In their combination of rationalism, humanism and mysticism, Rousseau, Blake, Hölderlin and Shelley were often profoundly Chinese without being aware of it.

⁷ It is interesting that Conger has seen a distinct congruity between the organic naturalism of modern science and the *philosophia perennis* of Asia, especially China.

¹ Cudworth wrote of 'that plastic principle in particular animals, forming them as so many little worlds.' One must bear in mind that his *True Intellectual System of the Universe* was written about +1671, the year before the publication of Malpighi's great work on the microscopic anatomy of the developing chick embryo. Precursors like Henry Power had long been in print, and the new world revealed by the microscope of van Leeuwenhoek was just becoming known. The instrument is admirably referred to by Cudworth.

² Cudworth is quoting directly from Plotinus, *Enneads*, II, 3, xvii. And he goes on to claim William Harvey as on his side (*De Gen. Anim.* ex. 49), not entirely justifiably.

³ On p. 232 we read that the plastic nature is no other than the Aristotelian vegetative soul. On p. 272 the general conclusion is reached that the plastic nature 'is either a lower faculty of some conscious soul, or else an inferior kind of life or soul by itself . . .' For (p. 255), it is neither matter, forms nor accidents, but incorporeal.

⁴ The *archæus*, a new name used by the 'Chymists and Paracelsians,' but not much differing from the plastic nature, is mentioned in vol. I, p. 232.

SOURCE READINGS: INTEGRATIVE MATERIALS AND METHODS

Amplifier Theory Applied to Biological Response

WITHIN recent years our understanding of biological behavior and mental activity has been aided by three mathematical and physical disciplines. They are: feed-back theory, information theory, and theory of games. To these, Dr. John R. Platt, of the University of Chicago, adds a fourth, complementary approach, called "amplifier theory." It is based on the parallels between biological responses in all living systems and electronic amplification processes. That such parallels do exist is not surprising, since man, as a biological system, and man's artifacts (such as amplifiers) are both expressions of those field forces which are now being recognized as dominants in nature.

In an article in the *American Scientist* for April, 1956, entitled "Amplification Aspects of Biological Response and Mental Activity," Dr. Platt points out that a neural response is an amplification process, whereby the energy of the selected input signal is used to trigger a much larger release of output energy. "These two energies may have any ratio, provided the output is strong enough to be relatively immune to statistical fluctuation. For a photomultiplier tube the energy amplification factor within the tube may be measured in millions, and the current released may then move a relay to control thousands or millions of times more energy still. In the biological amplifiers of the retina, the energy of the elementary light signal may be multiplied thousands of times in producing a single neural spike; and such a spike may operate a kind of biological relay and be multiplied many thousands of times more in the energy of a gross motor response."

Dr. Platt lists certain features which are common to all amplifiers: "The input transducer alone determines the kind of signal detected. Man-made amplifiers, with electronic amplification; and sensory nerve endings, with chemical and electrical amplification, must transduce their input signals into electrical or chemical terms before the signals can be amplified. . . . What each amplifier responds to depends entirely on the nature of its transducer.

"The increase of energy is supplied by the amplifier. The power supply must provide an energy several orders of magnitude larger than the signal energy."

Dr. Platt shows that it takes a macroscopic amplifier to detect a microscopic particle; an electronic amplifier may fill a laboratory, and the human eye is macroscopic in proportion to its lower measurement-limit of a few photons. "The purposeful human amplifier is a necessary part of the measurement process.

When the ruler lies on the table, the table is not being measured. When the dog or the indifferent maid looks at the ruler on the table, it is not being measured. It is only measured when an *interested* eye notes the spatial contiguity of photon patterns and *amplifies* the signal into an immediate or stored specific biological response. Measurement is amplification for a biological purpose. It is a link in the complicated human response-amplification chain.

"And the Feynman theorem can be enlarged to touch other fields. In biology *response is amplification*. In the theory of knowledge, *knowledge is amplification*. These assertions provide new approaches for viewing the nature of biological and nervous response and the organization and scope of the brain."

Continuing portions of the article discuss "Pulse Amplifiers and the Polar Option," "Amplification and the Nervous System," "Psychological Aspects of Decision Networks," and "Amplification and Knowledge." Dr. Platt concludes his article with the following words: "We speak of consciousness as being irreversible, as having a directed time axis; it is our amplifiers. The direction of stimulus and response is the direction of pulses across our neural net, the direction of flow of information, the direction of premise and conclusion, the direction of decision. And perhaps that is what we mean by the direction of time."

Dr. Platt is in the Department of Physics at the University of Chicago. His research interests have ranged in the far ultraviolet spectra, theory of chemical spectra, properties of hydrocarbons, and the design of infrared voice communications systems. His interest in the latter field has stimulated him to a study of and this interesting report on biological responses and mental activity.

—Alan Mannion

Organization: An Integrative Concept in Botany

IN the September 1955 issue of *The New Phytologist*, there appeared an article by C. W. Wardlaw entitled "The Chemical Concept of Organization in Plants."

The author points out that a considerable volume of recent work has been directed to the problems of morphogenesis in ferns and other vascular plants, the general aim being to advance knowledge of factors and relationships which may determine the characteristic form and structure of representative species. Botanists are becoming increasingly interested not only in the several phases and aspects of the individual development, but in the organization of the individual

as a whole. It is now recognized that in the plant kingdom there is, in addition to the overall organization of the adult individual plant, evidence that organization is manifested at the several different levels of development.

Dr. Wardlaw indicates his view that to explore and elaborate the concept of organization may be one of the most important tasks of our time. He defines the term as follows: "(Organization) may be taken to connote the distinctive form, structure and physiological activity, which develop with great regularity and fidelity in the individual plant of a species in its usual environment, the starting-point being the organized structure of the specific protoplasm of the zygote, spore, or other generative cell or cell group."

The paper emphasizes that in attempting to define more clearly what constitutes organization in plants—an organism being an organization—it should be recognized that a phase of speculation and theorizing must be undergone. Dr. Wardlaw lists several assumptions which he feels are likely to lead to new advances. The first of these is that "Gene-controlled metabolism, and the physical properties of certain of its products, determine the characteristic development of the individuals of each species, the zygote, spore, generative cell, or meristem, being envisaged as a complex organic (or organismal) reaction system which obeys the laws of physical chemistry." Also, "under the impact of genetical and environmental factors, and/or organismal relationships already established . . . the reaction system of an embryo or shoot apex becomes modified in characteristic ways during the development of the individual—a conception of the eventual morphological and histological developments."

As the principal morphological and histological facts of the embryonic development in all classes of plants have been ascertained with some degree of precision, an attempt should be made to explain the embryonic development in terms of growth, and it is suggested that the homologies of organization can be explained, at least in part, by envisaging the developing zygote as a reaction system.

After applying the basic assumptions relating to organization to a specific instance, namely, the shoot apex in vascular plants, the author concludes the article with a section entitled "Discussion and Outlook":

"The concept of organization, both in its general and special aspects, is likely to prove of increasing interest to botanists in the coming years. A particular merit of the theme is its essentially integrative character. . . . The need for this synthesis of data from many different sources makes the concept a difficult one to grasp and to state in a satisfactory manner. . . . Essential features of such a theory would be that it afforded, or seemed likely to afford, a satisfying explanation of the morphological, histological and cytological phenomena observed during the development of a selected plant and that it could assimilate the data of physiological genetics, experimental morphology and other branches that contribute to our knowledge of morphogenesis. The theory must also account for

the harmonious transition from one embryonic or development stage to the next.

"A comprehensive and adequate theory of organization is of paramount interest to the morphologist. But such a theory is probably of not less interest and importance to the physiologist, for it may well be that, in the future, the integration of botanical science—if indeed it becomes integrated—may take place round the concepts of growth and organization. Hersch (1941) has drawn an interesting contrast between what he calls the 'substance-minded' and the 'relation-minded' man. The morphologist traditionally, but not invariably, exemplifies the former type of observer: he tends to think of the developmental pattern in terms of the visible structural features seen at successive 'stages' during development; his records are illustrations and descriptions of these 'stages.' But if the morphologist is a student of morphogenesis, his outlook is rather different: he regards the pattern observed at any particular stage in development as the expression of the factors which produced it, and hence he thinks in terms of processes and relationships of various kinds . . . for a long time to come, and until a very different generation of botanists occupies the scene, an acceptable theory of organization must in some measure satisfy both the substance-minded and the relation-minded observer. . . .

"In the pattern-forming, reaction system envisaged here, different genes may have greater or less importance at different phases. It may be assumed that the reaction system of a particular species normally comprises certain ingredients, e.g. particular enzymes, proteins or protein precursors, growth-regulating substances, carbohydrates, and so on. The embryonic pattern or organization at any particular stage in the ontogenetic development will be determined by the substances which have entered into the reaction system up to that stage and by environmental and other factors. As the reaction system changes during the development of the individual organism, so also will the stable pattern to which it gives rise. The progressive elaboration of form and structure, or the 'reduction' of a more complex form, the harmonious transition from one developmental stage to the next, the epigenetic nature of plant development, and the manifestation of organization or integrated wholeness, are each and all the expression of a specific reaction system which changes continuously as growth proceeds. . . .

"In a recent book, Bonner (1952) regards morphogenesis, or the emergence of an organismal pattern, as being referable essentially to the progressive, constructive processes of growth, morphogenetic movement and differentiation; and to the limiting of these processes in various ways by intrinsic and extrinsic factors which check, guide and canalize them. He also considers that a sustaining aim in the study of morphogenesis should be a search for a micro-theory (or micro-structure theory) which would explain in a satisfying manner the general phenomena of development. . . . In the present writer's view, it seems

improbable that there can be any simple theory of morphogenesis. A micro-theory, as proposed by Bonner, would be valuable as far as it goes, but it would have its place as one component of a complex system. In the general conception indicated here, each individual development is based on a specific reaction system and each species is a unique physical system. But this reaction system, like the epigenetic morphological entity to which it gives rise, undergoes a series of changes during development, each successive state of the system being partly determined by the preceding ones, and in turn partly determining those that follow. . . .

"Growth and organization are essentially dynamic phenomena. When we study them we are essentially concerned with processes, of which the visible morphological and histological features are the result. There is still much important work for the experimental morphologist and taxonomist to do, but perhaps more than ever before, morphology and physiology should be regarded as aspects of one discipline. . . . Meanwhile, the concepts of growth and organization taken together afford a useful focal point for effecting some integration of the many and diverse contributions to our knowledge of morphogenesis in plants."

—E. B. Sellon

The Hypothalamus — Psychosomatic Switchboard

THE July-August issue of *Clinical Symposia*, a publication issued once every two months by the CIBA Pharmaceutical Co. (Summit, New Jersey) for the medical profession, is devoted entirely to the hypothalamus, the central switchboard in the brain which integrates visceral function, emotional reactions, and the basic states of consciousness, e.g. sleep and wakefulness. For all readers with an interest in the relations between psyche and soma who have access to a library which receives this publication, con-

sultation of the original article will be found rewarding. It is the work of Dr. W. J. Ingram.

The outstanding feature of the material presented is the splendid set of color illustrations, by the noted medical artist, Dr. Frank Netter, which gives the clearest and most vivid single picture of the anatomy and function of the hypothalamus and the pituitary gland which has yet found its way into print. This picture is related to the nervous control of all the visceral functions and the chemical control of the other endocrine glands subordinate to the pituitary in a further set of illustrations and in the excellent text, which also includes a discussion of the anatomy of the hypothalamus and the anatomical and functional relationships between this center and the pituitary. A brief bibliography is appended to the text.

It is difficult to summarize what is in itself a skillful summary of the basic patterns in the unconscious, automatic functioning of our bodies. Suffice it to say that a mass of brain tissue hardly larger than a walnut has in the past thirty years been found to be responsible for the control of an astonishing variety of functions, including rate and depth of breathing, the control of the heartbeat and blood pressure, the functioning of the entire digestive tract (including the sensations of hunger and satiety), the production, storage, and excretion of urine, the regulation of body temperature, the control of the extremely complex chemistry of the blood, sleep and wakefulness, etc. When it is remembered that the pituitary gland, which is controlled by the hypothalamus, is responsible for the balanced activity of all the other endocrine glands, including the sex glands, the adrenals, the thyroids, etc., as well as for the overall growth of the body, one gains some idea of the significance of this brain center. The role of the hypothalamus in the emotional life of man is becoming increasingly clear, and it appears to be a very considerable one. Several of the new tranquilizing drugs owe their effects to selective action on the hypothalamus, and in this field only the surface has been scratched.

—F. S. Woidich



NEWS AND NOTES

PROFESSOR Maslow is by no means alone in the convictions he expresses so lucidly in discussing the philosophy of psychology, elsewhere in this issue of MAIN CURRENTS. In fact he is putting bluntly what a number of his colleagues have long thought, but have not recently at least so frankly said. We venture to say that his words will have a very wide and eager reception, by professionals in all branches of psychology and by lay readers.

Nowhere has over-specialization been more evil than in the sciences of man. Surely it is proper to say that logic and mathematics are aspects of human psychology; hence that triumphs of the mind in science are important evidence as to the inner nature of man? Certainly it can be said that nothing puts so much pressure upon humanity as does technology as a social force, making it the proper concern of social psychologists, and of psychotherapists. Yet in the university and college catalogues one sees almost no sign of responsibility by psychologists for these superb triumphs of the human mind. Recently the head of a department of psychology in a very large university told the present writer that after years of trying to build up the department by the recruitment of representatives of all aspects of psychology, he found that the net result was that the department was teaching mostly physiology, in a kind of back-handed fashion. (The conversation did not go on long enough to make sure whether it was even human physiology).

The psyche of men and of mammals may be much the same, at the animal level. But the root of human nature is in our ability to examine ourselves. This makes us unique. To neglect the study of this, the cognitive root, and of all that appears in man with it—ability to classify, recognition of principles of beauty and of goodness, and so on—is to neglect the human race.

A notable movement is proceeding in diverse forms in church circles, showing an awakening there to the possibilities of making juncture with the science of our times. A Society for the Scientific Study of Religion has come into being. (Particulars may be obtained from Dr. W. H. Clark, Secretary, Hartford Seminary, Hartford 5, Conn.)

For a few years meetings have been proceeding at Star Island, forming up into an organized movement dealing with Religion in an Age of Science. Information about this can be obtained from 355 Boylston Street, Boston 16, Massachusetts.

Both of these organizations work steadily with scientists, as such. That is to say, they are not concerned chiefly with discovering practitioners in science who, in their private lives, are also religious men. Their programs are directed to a philosophical re-interpretation of science, in contemporary terms, now that the

reality of the non-material has been established upon reason and evidence, as it is in field theory.

In some ways more searching is a development proceeding around Professor P. A. Sorokin of Harvard, intended to further research in creative altruism. The concept here seems to be that man is supra-logically in touch with reality in ways which are displayed not only in the postulational-logical structuring of some parts of science, but also through affective channels of love and beauty. The heart of the business is creativity. Invaluable work will be done.

There has now been announced a National Academy of Religion and Mental Health. The signatories of the announcement are Kenneth E. Appel, M. D., President, and Otto Klineberg, Ph.D., member of the Advisory Council. The address is Academy of Medicine Building, 2 East 103 Street, New York 29, N. Y. The trustees and advisory council include leading men in pertinent departments of learning and public affairs. We quote from the prospectus what seem to us the really key words: "What a man believes is a factor in his emotional health. The problem of mental illness includes the disorganization of an individual's philosophy of life." It is not clear from the announcement how much attention this powerful movement may give to the actual working up of materials for a valid philosophy. Herein the announcement promises little or nothing.

Workers in the field that is to unite religion and science must never forget that in the United States they are obliged to work within the framework of a *secular* school system. It follows that those universals which can be demonstrated as reasonable, as part of natural order and the divine and sublime laws of the universe, can be taught. Dogmas and creedal variations upon these themes can have little place.

Central to all such endeavor is the still too-neglected program of studies of the nexus of natural principles in which man is enmeshed by reason of his imprisonment to life and energy, and the study of the means by which man can understand those principles. There is a clearly defined methodological procedure to be used, improved, applied, in new ways, and made universally known. There is such a thing as valid public philosophical knowledge. Today this can include—indeed, must feature—the non-material real, as a scientific fact. When this body of principles has been made clear, religion, psychotherapy, psychology more generally, and all aspects of human life and knowledge will have the anchorage they need and do not as yet have. The quest for the quiet mind rested upon confidence in an ordered and meaningful universe can, as of today, be successfully taken up, financed, and seen through.

—F. L. K.

REVIEWS

An Opening Door to Chinese Culture

THE second volume of Joseph Needham's unique, authoritative and wonderfully readable treatise, *Science and Civilization in China*, takes us over the threshold of this great enterprise, and shows that it will be more by far than a cultural history. If it receives the wide circulation it deserves, it can prove to be a contribution to world peace. (Cambridge University Press, Vol. I, 1954, 318 pp, illus, index, \$10.00; Vol. II, 1956, 697 pp, illus, index, \$14.50.)

So much can be said because the work does justice to China, showing the inter-connections with Europe, and is thus fitted to lead and to prompt a series of works which could re-establish confidence in the human cultural potential.

Elsewhere in this issue of MAIN CURRENTS will be found a representative example of Needham's resources in knowledge and expression, taken by kind permission of the author and the Syndics of the Press, from this second volume. With that before the reader, we propose to justify the statement made above, by examining some reasons why world peace waits upon the use, in policy and program, of the basic fact that the human species is biologically one, the world over, despite secondary characteristics derived from ethnic specialization and social habit.

Observation, history and experiment (through education) show that this specificity is accompanied by a psychological and cultural potential, which also exists in all men, for language, music and other arts, for mathematics and science, for philosophy, mysticism, religion, sport, ethics and the like, whatever incidental or even profound variations may occur. The universality of this cultural potential must be admitted and exploited if the biological specificity is to have the facilities it requires for social expression.

An urgent question therefore confronts us: What means are at hand with which to penetrate to the root of the cultural ground potential, so that education and worthwhile experience generally may be brought to serve the world of the immediate future, so that nations may be related by other means than expediency, compromise, juridic patchworks, armed vigilance, colorless neutrality, fear, and furious adjustments to industrial, commercial and financial pressures?

It is, of course, unrealistic to suppose that diversity of human cultural gain is to vanish and be lost. If any European thinks this, he should first consider Europe, and ask himself what has become of the societies which once eddied around agoras, acropolises, capitol hills, cathedrals and abbeys, in the form of phratries, guilds, seignories and the like. Physically those societies have been transformed, but an ethical-psychological-philosophical nexus of mores and language derived from that past provides continued nourishment for mind and soul.

Therefore Needham is indispensable. He shows the high rank of China in the cultural enterprise, and enables us to correct our deplorable ignorance in that area. With his help we can draw upon China for its expres-

sions of the universals of historical reality, while its cultural specialization is still being expressed (not yet utterly lost) in particular modes of life, costumes, forms of society, language, literature, religion, arts, sciences, games, and the like.

The search for these universals is urgent, for the denial and destruction of the values of the past go on so rapidly, and new knowledge and skills are so disordered, so disproportioned, and so limited in extent, that human life is degraded and threatened. This certainly applies to China as to other countries, both Eastern and Western.

There may be some who believe that a local, passing formulation of culture will supplant all the rest through the use of fashion, motion pictures, television or other selling arts. They may seriously entertain the idea that the united peoples of the world are henceforth to be inspired by the output of electronic calculating machines, to be controlled by TV signals, to be nourished (and at the same time sterilized) by chemistry.

To expect this is to assume that nothing important happened before (say) Galileo, and that everything that has happened since controverts religion. Such a position betrays ignorance of the fact that the finest parts of contemporary science itself are triumphs of spiritual and creative culture. Isaac Newton, Albert Einstein, J. C. Maxwell, M. A. Bravais and others had to find, by inspiration, postulational roots suited to the infinite over-arching real, to create mathematics as required, and thus to function perfectly in the ideal domain in order to give us partial mastery of things material. They are but part—a priceless part—of the cultural enterprise which all sages and seers, poets and philosophers have served, evoking principles of truth, beauty and goodness which lie beneath the seeming.

Here again Needham is invaluable. He shows how the doctrine of the Tao, the universe as law and order, was arrived at without the help of that kind of development. The Chinese mind operated through what he calls "correlative thinking," in such a manner that concepts and workable ideas frequently came out as critically useful inventions, without conscious systematic, i.e. classifying, connections. In the third and subsequent volumes we shall learn how that kind of mind led to the mariner's compass (and hence to Columbus and the West!), printing with movable type, and gunpowder, which we have put to such high uses as pulp publications and war. (As is well known, the Chinese developed gunpowder for fireworks.) Reviewers will then have something more concrete to work upon than is afforded by these two first volumes.

So much for science by itself. As to civilization and science as part of the good state of mind which leads to civilization, surely that starts with social sciences and wisdom applied to human affairs: *sapientia*. Confucianism formulated this in China, and it contrasts sharply with the emulsion shaken up in the West: ideals, which anyone can repeat, mixed with skills, which, once devised, any gangster can employ.

Civilization depends also upon knowledge: *scientia*. Under this head Needham examines all the chief factors for and against the development in China of the struc-

tured science which Europe has achieved in physics and chemistry, and has so far failed to disclose in the sciences of life and man. He shows what was done in physics and invention without a comparable success in structuring, and also how, by correlative thinking, this lack was compensated for by using the third ingredient for the good and civilized mind which concerns the proportioning process: *ratio*, supremely embodied in the self-proportioning forms of living nature. Happily Joseph Needham is a renowned biologist. He is at home in those deep and rich intuitions of living order which the Chinese strove to bring forward in the *I Ching* and other classics. Needham has summarized his findings on this vital point in his Hobhouse Lecture, *Human Law and the Laws of Nature in China and the West*, Oxford University Press, 1951; but in the present second volume of *Science and Civilization in China*, all aspects are presented, as if in some soft, rich, strong brocade, of the means and degree in which the Chinese achieved their profound understanding of man and of man's relation to natural moral law.

As to the books physically, Volume I, Introductory Orientation, outlined the whole vast undertaking in 248 pages of text, 50 of bibliography, 20 of index and over 36 pages of illustrations and maps. Volume II begins the substantial exposition of the theme promised, and contains 583 pages of text, 33 superb illustrations, 12 comprehensive tables, 64 pages of bibliography in Chinese, Japanese and other languages, and 42 pages of meticulous indexing. There will follow five more: on mathematics and the sciences of the heavens and the earth; on physics, engineering and technology; on chemistry and industrial chemistry; on biology, agriculture and medicine; on the social background.

The learning, comprehensiveness and style are unmatched. Yet (as indicated above) it is not these which in themselves constitute this work a great force, as we see it, for world settlement. It is the fullness and fairness, combined to elevate the reader's mind and hopes. The author, as a leading biologist and philosopher of science, is at home with the history of European cultural thought not only as it has been, but as it now stands, amid quantum mechanics, field theory, relativity, and the like. In terms common to East and West he is reviewing for us the details and the configurations of the whole range of Chinese scientific knowledge and of knowledge about China. Every indigenous classical work and every chief school of thought and of mysticism is assessed, along with European contributions, in those universal terms. Needham and his dozens of consulting scholars are disclosing the mind and soul of China, the force with which we must live. Thus he provides, as respects China, what the combined resources of governments, Unesco, and cultural-educational funding foundations have so far not provided.

To be sure, the withering blast of mechanization and physicalism will hit the Chinese more and more, just as it has long blown upon our lives, thoughts and feelings. But no society of men, being human, can deny forever the heritage from that level whence "our being descends into us." The Chinese are learning industrialization, but, no more than we, will they be content to remain earthworm consumers and producers. Whatever the number and degree of the interruptions suffered by them as they sought truth through Taoism, Confucianism, Zen, Mohism—and now by modern science and technology—the Chinese people will bring to the settled

world of the future their fair contribution. To know now, as we can know from these volumes, what that will be accelerates the coming of that day.

Needham is seeking and stating for us, in one model form, the true genesis of that world-wide species, man, in the whole sum of his cultural and scientific creations, the Chinese being but his case in point.

In the face of a labor so prodigious it may seem petty to note any deficiencies, but one point is too important to neglect. May we not hope that in some one of the future volumes in this series the author will explicitly correct the impression readers may get that Buddhism itself in fact denies the meaningfulness and worth of life? This European pessimism derives from Schopenhauer, not from Gautama. It is true that the skandhas, being material, are a flux. Even Nirvana, Paranirvana and Mahaparanirvana may be but force fields (so to speak), manifesting locally a non-material universal real. True attainment implies extinction of egotism, of Atman taken as separate self. But the whole point of Buddhism is that it provides, as empirical outworkings, a mode of life that leads to the real. Thus it is a supremely scientific religion no matter how well or ill any person or nation may have lived it out.

We learn that the Bollingen Foundation provided "certain financial aid towards the production of this book." In this way—and through a few scholars in the United States included as consultants—Americans have had a helpful part.

Thinking forward, one wonders whether the Bollingen Foundation might not be even more beneficent towards world peace if it were to commission at once the writing of a volume that would prompt an enterprise similar to this work, in respect to Indian heritages and intellectual invention? Naturally, such a great undertaking should be directed by Indians when at last it has been begun. We must have from Indians a work to match for Indian cultures the Buddhist Encyclopedia, now in preparation under the general editorship of Dr. G. P. Malalasekara. But do we not need a preliminary volume, merely exploring the field in terms of American and world needs? Such a volume would help set in motion in respect to India a study comparable to this one done for China with such success by Joseph Needham.

—F. L. Kunz

The Meaning in Words

LANGUAGE and the Pursuit of Truth by John Wilson (Cambridge University Press, N. Y., 1956, 105 pp., \$1.75) is such an excellent little book that we hope its arrival on the scene will mark the beginning of a renewed effort to watch our words.

One is saddened to be forced to admit that education at all levels is still failing to cope with the dangerous use of words transmitted by our new superb mass media of communications. From singing commercials, to political speeches and sermons, words—especially loaded words and evaluative words—are pounded into the ears of millions who are ignorant of the function of words and who take the processes of communication for granted.

While this is a book on semantics and linguistic communication and while its final chapter discusses the

question "What is Truth," this is a non-technical piece of writing which has lost nothing in the process of simplification.

There are only three chapters: One on words, their types and mistakes made in their use; one on statements, their types and functions and verification; and the previously-mentioned chapter on truth, its conditions, the basis of meaning and verification, value statements and metaphysical statements. Each is excellent and can very easily be modulated to the level of any classroom by any alert teacher. Let us hope that many teachers will do so.

And let not any specialist in any field so delude himself as to think that this book concerns the English and the Philosophy departments. At base, every problem is metaphysical and linguistic, and every human advance has derived fundamentally from the expressing of concepts in words. Hence books such as this concern us all.

—Harvey W. Culp

The Potential of College Teaching

THERE is no denying that colleges and their faculties must begin immediately to prepare for the inevitable flood of students that will be knocking on their doors within the next decade.

College Teaching: Its Practice and Its Potential by Joseph Justman and Walter H. Mais (Harper & Brothers, N. Y., 249 pp., index, \$3.75) is an important book at this time since it is a sane and well-balanced study of the problems, methods, and objectives which colleges and college faculties face.

While it is generally realized that the student population in colleges has increased in recent decades, it is not so well-known that the student population has changed in its nature. It is important not only for the faculty member to know the nature and the extent of changes in the class make-up that he faces. It is just as important for everyone else to understand that the labels "college student" or "college graduate" apply to different socioeconomic and educational backgrounds, to different motivations and to different characteristics as learners than might have been the case a generation or two ago. And it is of vital importance that we be clear about these and related matters in the years ahead, in which the number of college students will be far greater than it is today.

We like the review of the current changes in curricula that are being tried to meet the needs of the present population and to prepare for the on-coming rush. And, of course, we are pleased to note the attention which the authors pay to "integration."

We find that this book is more thorough in its analysis of the art of teaching, the responsibilities of the teacher (as instructor, as scholar, as faculty member, as counsellor, as citizen) than most others we have read.

The same breadth and sensitivity is to be found in the discussion of teaching methods. No one method is "sold" to the reader. By virtue of their long experience the authors seem to have come closer to the realities of truly sensitive teacher-student rapport than most others. They have very successfully avoided the pit-fall of turning this part of the book into a "how to teach" handbook.

Finally, we know that students would appreciate the same chapter on "Evaluating Learning and Teaching." Clear distinction is made between *measurement* and *evaluation*. At last we have a forthright admission that it is the duty and responsibility of teachers to *measure* the measurable by the best means and then to balance this objectivity with the best means possible for assessing those outcomes of his teaching which can only be *evaluated*.

We pray that this book may quickly work its way into teacher training colleges where, because of its influence upon teachers-to-be, its impact may spread to schools and colleges.

—Harvey W. Culp

CANADIAN Education Today, A Symposium edited by Joseph Katz (McGraw-Hill Book Co., Inc., N. Y., 1956, 243 pp., \$3.95) gives the reader a comprehensive survey of Canadian education, whose problems closely parallel our own. "In total," we are told on the jacket of the book, "the essays (by twenty Canadian educators) provide a wide variety of views held about education in Canada. They provide, too, a description of the numerous systems of education to be found in the Dominion."

We, on the State-side, have been so preoccupied in recent years with the intensity of our own arguments concerning education that we have very seldom paused to inquire how our neighbors are making out in the solution of their indigenous problems.

Obviously, no one formulation of the aims of education can yet satisfy all the factors in a complete cultural situation like Canada's, and no single method or system yet tried can give a uniform educational pattern to the nation. Yet, we gather from these essays the distinct impression that, though conservative, Canada is experimenting. The experimentation, however, is not so drastic as some we have now.

Perhaps, State-side educators, by reading this book, can gain some perspective of, and insight into, the problems which preoccupy them.

FOR some years now, Mentor and Signet Books have been performing a public service for the American people by presenting in inexpensive, readable, paperback form some of the greatest contributions to human thought, drawn from all ages and cultures, from ancient religion to modern philosophy of science. To their long list of significant titles, recent releases add *Good Reading*, prepared by the Committee on College Reading and edited by J. Sherwood Weber, which lists over 1500 useful and entertaining books from all periods and fields, including literature, history, religion, philosophy, the sciences, psychology, anthropology and politics; *The Papal Encyclicals*, edited by Anne Fremantle, which presents the edicts of the Popes in their historical context; *American Skyline*, by Christopher Tunnard and Henry Hope Reed, a discussion of American culture as embodied in the growth and form of cities and towns; *Christopher Columbus, Mariner*, by Samuel Eliot Morison, who, as a naval man himself, recreates with some authority the excitement of those early voyages; and Boswell's *London Journal*, edited by Frederick A. Pottle, which brings to a wider audience this vivid commentary on the eighteenth century scene which created such interest when first published in 1950.